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TWENTY-FIFTH ANNUAL REPORT

— OF THE —

South Carolina Experiment Station

— OF THE —

Clemson Agricultural College

FOR THE YEAR ENDING

JUNE 30, 1912.

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TWENTY-FIFTH ANNUAL REPORT

— OF THE —

South Carolina Experiment Station

— OF THE —

Clemson Agricultural College

FOR THE YEAR ENDING
JUNE 30, 1912.

1913
Oulla Printing & Binding Co.
Anderson, S. C.

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W. M. RIGGS, B. S., E. M. E., LL. D., President.

EXPERIMENT STATION STAFF.

J. N. HARPER, B. S., M. Agr., Director, Agriculturist.
C. C. NEWMAN, B. S., Horticulturist.
H. W. BARRE, B. S., M. A., Botanist and Plant Pathologist.
A. F. CONRADI, B. Agr., M. S., Entomologist and Zoologist.
THOS. E. KEITT, B. S., Chemist.
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MISS HELEN BRADFORD, Stenographer.
MISS DOROTHY MONTGOMERY, Stenographer.

Mail and Telegraph: Clemson, S. C.
Freight and Express: Calhoun, S. C.

The Bulletins of the Station are issued at irregular intervals, and sent free to all citizens of the State who apply for them.

LETTERS OF TRANSMITTAL.

Clemson College, S. C. December 1, 1912.

Hon. Alan Johnstone, President Board of Trustees, The Clemson Agricultural College.

Dear Sir:—I beg to submit herewith the Twenty-Fifth Annual Report of the South Carolina Agricultural Experiment Station, which in accordance with the law, must be submitted to the Governor on or before February 1, 1913.

Yours very truly,
W. M. RIGGS,
President.

Clemson College, S. C. December 1, 1912.

Hon. Coleman L. Blease, Governor of South Carolina.

Sir:—I have the honor to submit herewith the Twenty-Fifth Annual Report of the South Carolina Experiment Station in accordance with the requirements of an Act of Congress, approved March 2, 1887, for the establishment of Agricultural Experiment Stations in connection with the colleges of the several States, organized under the provisions of an Act approved July 2, 1862.

Respectfully submitted,
ALAN JOHNSTONE,
President Board of Trustees.

ANNUAL REPORT OF DIRECTOR OF SOUTH CAROLINA EXPERIMENT STATION.

Clemson College, S. C., July 2, 1912.

Dr. W. M. RIGGS, President,
Clemson College.

Dear Sir:—I have the honor of submitting herewith the Twenty-Fifth Annual Report of the South Carolina Experiment Station for the fiscal year ending June 30th, 1912.

As previously reported, most of the work that is now under way is a continuation of that planned a number of years ago. We have not added any new Adams projects during the year. As heretofore, the correspondence of the Station officers has continued to increase. I consider this one of the most important features of the work, and we are thus enabled to give to the farmers information along lines that would be most appreciated and of greatest value.

During the year, almost every member of the Station Staff has given assistance to the Superintendent of the Extension Division in conducting institutes in various parts of the State. The Station, in co-operation with the other departments of the College, made a splendid exhibit at the State Fair last autumn. This exhibit was viewed by thousands of people and was of such a nature that it received most favorable comments, and it was of real educational value.

We are continuing to co-operate with the Department of Agriculture in a number of experiments. The Agricultural Division is co-operating with the Bureau of Plant Industry in testing a number of varieties of barley, one variety of which is of especial value, as it is practically free of beards. If we can establish this variety, it will be of great value to stockmen to plant with vetch for hay. We can get much larger yields of barley grain in this State than of wheat. This is especially true when planted on rich land. We continue to send a great deal of soil for inoculation purposes to be used in inoculating bur clover, crimson clover, red clover, etc.

The Division of Entomology is co-operating with the Bureau of Entomology at its laboratory established at Marion, S. C. Prof. Conradi has issued one or two publications giving the results of this co-operative work.

The Division of Botany continues its co-operative work with the Bureau of Plant Industry in making a plant disease survey of the State, and in developing varieties of cotton immune to wilt. As the cotton wilt disease has caused considerable loss to the Pee Dee section, and as Prof. Barre has a number of varieties that are resistant to this disease, we are expecting this work to become of great economic importance, and it will cause a saving to the farmers in the lower section of the State, of many thousands of dollars; in fact, its value can hardly be estimated. Prof. Barre is co-operating with the Bureau of Forestry in testing a number of varieties of trees planted at the Coast Experiment Station. The inspector from the office of Experiment Stations has passed upon all of our accounts and has looked thoroughly into the nature of the experiments that we are conducting. We have met all of the requirements of that office.

Our mailing list continues to grow. We now have our bulletins printed in editions of 18,000 copies.

The following is a list of the Adams projects now being investigated:

1.—Investigation of strongyloid parasites of the intestinal tract of ruminants. (Division of Entomology and Zoology and Animal Husbandry.)

2.—Temperature in its relation to insect activity. (Division of Entomology and Zoology.)

3.—Physiological and pathological effect of feeding large amounts of cotton seed meal to cows. (Division of Animal Husbandry and Division of Chemistry.)

4.—An experiment to determine the cause of cotton seed meal poisoning in hogs. (Division of Animal Husbandry and Division of Chemistry.)

5.—The effect of pollen from barren stalks of corn on the yield of corn. (Division of Agriculture.)

6.—A study of the relation that exists between soil types and the length of the fibre of cotton. (Agricultural Division.)

7.—Experiments to determine the effect of foreign pollen on the productiveness of the varieties of Rotundifolia grapes. (Horticultural Division.)

8.—Study of life history of the fungus which causes anthracnose of cotton and experiments relative to controlling same. (Division of Botany and Plant Pathology.)

9—Studies to determine the relation that exists between the moisture evaporated by plants to the amount of nitrates in the soil. (Agricultural and Botanical Divisions.)

10.—Some factors affecting the composition of cotton seed with special reference to the content, location in the seed, and form of phosphoric acid in the upland varieties of cotton. (Chemical Division.)

11.—The study of the influence of environment on the inheritance of certain characters in vegetables. (Divisions of Horticulture and Plant Pathology.)

12.—A biological study of the slender wire-worm (Horistonotus curiatus.) (Division of Entomology and Zoology.)

13.—Causes of shedding in cotton. (Division of Botany and Plant Pathology.)

14.—The causes of the partial insolubility in water of potash salts when mixed with basic slag. (Division of Chemistry.)

15.—A study to determine the influence of different soil types on the chemical composition of certain plants. (Division of Agronomy and Chemistry.)

The Hatch experiments being conducted are as follows:

Agricultural Division.

1.—Experiments to determine the fertilizer requirements of the upland soils of South Carolina for the various staple crops when grown in a number of different rotations.

2.—Experiments to determine the best system of rotating crops with a view to keeping up the fertility of the soil.

3.—Cotton variety tests on different soil types.

4.—The breeding of cotton with a view to increasing the length and quality of the fibre, the size of the boll, and general vigor of the plant.

5.—The breeding of corn with a view to increasing the yield of grain, and the size of the stalk for silage.

6.—Experiments to determine the relative value of a number of different sources of ammonia when applied to cotton, corn, and oats.

7.—Continuation of experiments to determine the best time of applying nitrate of soda to corn, cotton and oats.

8.—Experiments on application of commercial fertilizer to corn at different periods of its growth.

9.—Continuation of the testing of various forage crops and cereals.

11.—Variety tests of wheat, corn, cowpeas, and sweet potatoes.

12.—Experiments with various winter cover crops.

14.—Experiments to determine the best form of phosphorus to apply to granite soils.

17.—Experiments to determine the extent of modifying the corn plant by different cultural methods.

Horticultural Division.

1.—Experiments with grapes: (a) pruning; (b) in training the vines; (c) in breeding and in testing about 125 varieties.

2.—Experiments in the breeding of resistant varieties of asparagus to the rust disease, and in testing the value of male plants as compared with the female plants.

3.—Experiments in the breeding of okra.

4.—Variety tests with persimmons.

5.—Experiment to determine methods of combatting pear blight.

6.—Variety tests with apples, with a view of obtaining varieties that are well suited to the Piedmont section.

7.—Experiments in testing varieties of peaches.

8.—Experiments in testing a number of varieties of vegetables, and also the fertilizer requirements, and the best time for planting and cultivating.

Division of Botany.

Prof. Barre has devoted most of his time to the cotton anthracnose investigation. He has devised a method by which this disease can be easily kept in check and eventually eradicated. This will mean a great saving to the farmers of the State. His Hatch problems have been largely in working out methods of keeping the sweet potato. He has continued his plant disease survey of the State and has gotten a large mass of information about a great number of bacteria and fungus diseases that attact our fruits and vegetables. A number of these diseases are widely spread throughout the State.

Division of Entomology.

Prof. Conradi has located at Marion and Colleton counties field laboratories, and at each place has an assistant located. His assistant at Marion, Mr. W. A. Thomas, has devoted most of his time to working out the life history of the cotton root louse. Mr. Thomas' work has been of high order, and he deserves our special commendation. In Colleton County, Prof. Conradi is having his assistant work out the life history of the corn wire-worm. This insect is so widely scattered over Berkley and Colleton counties that it is almost impossible for farmers to raise corn profitably. Prof. Conradi has devoted most of his time to State work. Besides his Adams projects, he has done practically no experimental work of his own during the past year. It takes a good deal of his time keeping up with his two assistants and looking after his co-operative spraying work and Adams projects.

Division of Chemistry.

Mr. Keitt has devoted most of his time to the Adams projects. He has also done considerable miscellaneous analytical work. His work in analyzing the oat plant at its different stages of growth has been most complete. He has issued a very valuable bulletin on the results of this work. Mr. Keitt now has charge of all of the fertilizer work being done by the Station.

Division of Animal Husbandry.

The work of this division has continued mostly along the lines begun several years ago. Prof. Smith fed a number of steers, and is to issue a bulletin on this subject soon. The work begun several years ago by the Station to determine the physiological effect of feeding large amounts of cotton seed meal to dairy cattle has been continued. Our results show conclusively that when dairy cattle are fed as large amounts as six or seven pounds of cotton seed meal per day for a very long period of time, a number of physiological disturbances take place that are injurious to the cow. This Station now has a splendid herd of Berkshire hogs, and the Station has sold throughout the State a number of high-class Berkshire pigs.

Under the provisions of the Hatch and Adams Acts, the work of the Experiment Station is restricted to the prosecution of work only along investigational lines. The Station has, however, by means of College funds, conducted a number of co-operative experiments with the farmers. The Agricultural Division is co-operating with about 150 farmers, mainly in the testing of varieties of cotton, corn, oats, sorghum, cowpeas, and clovers, and with fertilizer experiments with cotton, corn and oats.

The Division of Entomology is co-operating with a number of farmers located in Horry, Colleton, Marlboro, Darlington, Greenville, Spartanburg, York, Richland, Anderson, Edgefield and Kershaw counties in methods of spraying for the plum and peach worms, and various scales, the cotton boll worm, the cotton wire-worm, the corn bill bug, the cotton root louse, etc.

The Division of Botany is co-operating with a number of farmers in spraying to prevent brown rot, scab of peach and plum, and methods of preventing rust and leaf blight.

Respectfully submitted,
J. N. HARPER,
Director.

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION IN ACCOUNT WITH THE UNITED STATES

APPROPRIATIONS, 1911,1912.

Dr.	Hatch Fund	Adams Fund
To balance from appropriations for 1910-1911.		
Receipts from the Treasurer of the United States, as per appropriation for fiscal year enled June 30, 1912, under Acts of Congress approved March 2, 1887 (Hatch Fund,) and March 16, 1906 (Adams Fund)	$15,000.00	$15,000.00

Cr.

	Abstract.	Hatch Fund	Adams Fund
By Salaries	1	8,008.36	7,799.97
Labor	2	2,842.25	3,336.01
Publications	3	813.88	------
Postage and Stationery	4	276.71	137.12
Freight and Express	5	70.86	79.88
Heat, Light, Water and Power	6	73.95	105.62
Chemicals and laboratory supplies	7	103.59	231.69
Seeds, Plants and sundry supplies	8	447.17	532.98
Fertilizers	9	501.72	378.33
Feeding stuffs	10	497.83	1,036.76
Library	11	92.21	83.90
Tools, machinery and appliances	12	284.11	52.50
Furniture and Fixtures	13	45.00	------
Scientific aparatus and specimens	14	12.11	547.03
Live stock	15	240.00	200.00

Traveling expenses	16	127.35	187.10
Contingent expenses	17	25.00	-------
Buildings and land	18	537.90	291.11
Balance	------	------	------
Total		$15,000.00	$15,000.00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Treasurer of the South Carolina Experiment Station for the fiscal year ended June 30, 1912; that we have found the same well kept and classified as above; that the balance brought forward from the preceding year was $---------- on the Hatch Fund, and $-------- on the Adams Fund; that the receipts for the year from the Treasurer of the United States were $15,000.00 under the Act of Congress of March 2, 1887, and $15,000.00; for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving balances of $-----and $-----

And we further certify that the expenditures have been solely for the purpose set forth in the Acts of Congress approved March 2, 1887, and March 16, 1906, and in accordance with the terms of said Acts, respectively.

(Signed) M. L. DONALDSON,
Acting Chairman, Finance Committee,
Auditors

Attest:
P. H. E. SLOAN,
Custodian.

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION

1911-1912.

(Supplementary Statement.)

(This supplementary statement, while not required by law, is desired as an aid in interpreting the account rendered for the United States appropriation. While it will be more useful if made in conformity with the schedule fixed for that appropriation, if this is not practicable such a summary of receipt and expenditures from the sources indicated below as can be conveniently prepared from the books of the Station may be substituted. Whenever practicable it should be for the fiscal year ended June 30.)

Debtor.		
To balance on hand	$4,901.57	
Receipts from other sources than the United States for the year ended	2,233.54	$6,935.11
Credit.		
By Salaries	883.32	
Labor	533.11	
Publications	1,173.03	
Postage and stationery	29.73	
Freight and express	79.98	
Heat, light, water and power	34.05	
Chemicals and laboratory supplies	40.40	
Seeds, plants and sundry supplies	322.03	
Fertilizers	299.93	
Fedding stuffs	341.33	
Library	42.26	
Tools, machinery, and appliances	229.90	
Furniture and fixtures	128.58	
Scientific apparatus and specimens	261.75	
Live stock	104.00	
Traveling expenses	180.78	
Contingent expenses	------	
Buildings and land	186.11	$4,870.29
Balance	----------	2,064.82

REPORT OF HORTICULTURIST.

Clemson College, S. C., Dec. 10th, 1912.

Prof J. N. Harper, *Director,*
South Carolina Experiment Station.

Dear Sir:—I respectfully submit herewith a report of the Horticultural Division of the South Carolina Experiment Station for the fiscal year ending June 30, 1912.

During the past eighteen months there has been unusual interest shown throughout the State in the development of both the trucking and fruit industries. In many instances large areas have been purchased by Northern capitalists and preparations are being made for extensive operations in trucking and fruit growing. There has also been unusual interest along horticultural lines by the citizens of the State, as has been shown by the great increase in the correspondence of this division. We have frequently been called on for information in regard to the varieties of fruits best adapted to the coastal plain that we were not in position to give, because as yet no experiments with varieties of fruits have been conducted in the eastern part of the State. This emphasizes the importance of pushing the horticultural work as planned at the Coast Experiment Station.

Work at the Coast Experiment Station.

I regret to report that the horticultural experiments at the Coast Experiment Station have not been given the attention they demand. My instructions in regard to the care of the orchard especially were not carried out. This I suppose had to be neglected. I hope, however, that that was being carried on at the Station and something I suppose that had to be neglected. I hope, however, that in the future we will have no room for complaint along this line. The experiments as planned at the Coast Station will be of the greatest value to the fruit and truck growers throughout the coastal plain, and I, therefore, wish to emphasize the importance of this work.

Many of the experiments conducted at the Station at Clemson College in the past should be duplicated at the Coast Station as the soil and climatic conditions of the two stations are so different. Conclusions drawn from experiments conducted here will not apply to conditions in the coastal plain. The great demand for information in regard to fruit growing, especially in the eastern half of our State, shows the necessity for pushing the experimental work at the Coast Station as rapidly as may be practicable.

Co-Operative Experiments.

This division is now co-operating with many fruit growers in various sections of the State who have orchards underway of the standard varieties of fruits, and who are also testing newer varieties as they are introduced. In this way we are able to gain considerable information in regard to the adaptability of the different varieties of fruits to these particular localities. In this work we necessarily have to depend largely upon reports from the fruit growers themselves, and as many of them are not familiar with the varieties of fruit, there is always room for mistakes to occur in regard to the identity of the varieties. As far as possible, I believe that this work should be on the branch Stations and the notes and records made by an officer of the Experiment Station who is trained in this line of work.

Work Under the Hatch Act.

This division has for some years been conducting experiments in breeding apples, our object being to originate if possible, winter varieties well adapted to this section of the State. In addition to the work of breeding we have collected promising varieties, originating throughout the Piedmont belt. Some of these varieties have come into bearing and have proven to be very satisfactory indeed and promise to be of great value to the Piedmont fruit growers. *Scott's Cluster,* a variety which originated in Oconee County, has proven to be well adapted to this section. This is an early bearer. The fruit is of good quality and keeps well throughout the winter. This is not an especially attractive variety but one that will appeal to those who are growing fruit for home use. The *Black Winesap* is another seedling that has fruited for the past three years.

While this variety does not reach perfection in this locality, it is superior to the majority of our winter apples and is especially recommended for the Piedmont belt. The Rabun fruited for the first time this year, but the apples were stollen before they reached maturity. We are, therefore, unable to make recommendations as yet in regard to this variety. Indications are, however, that it will be of value as a late winter apple. Unfortunately this variety is more subject to blight than any we have tested. The Black Winesap and Scott's Cluster showed little signs of the twig blight this season, while the majority of varieties in the orchard were seriously affected. After another season we will probably be able to report on at least a dozen varieties originating in the Piedmont region of this State.

Our breeding experiments with grapes have also been continued. We now have a large number of seedlings originated during the last four years. Some of these fruited last season and a few appeared to be of especial value. This work will be continued.

Our experiments in breeding varieties of okra have been completed and our report on same will be publishel this fall. We have produced a variety which we claim to be superior to any other variety. In breeding this variety, our object was to produce a variety that would begin to bear early and continue to bear until frost. In this respect, we have been entirely successful as the variety begins to fruit at twelve inches high, and continues to fruit until killed by frost. We also endeavored to produce a variety as productive as possible and by breeding and careful selection year after year, we have produced a variety which produces two pods for every inch of stalk, with the exception of the late pods formed just before frost which will average about one pod to the inch of stalk. On the average there will be one pod to every ¾ inch of stalk. The okra pod remains tender longer than any variety tested. It is free from spines and may be gathered with the hand. We are now preparing to send seed of this variety to all of the Experiment Stations throughout the South for testing.

Peaches.—During the past season we have had an excellent opportunity of making notes on more than 100 varieties of peaches. Our four year old variety orchard produced its first crop of fruit, every tree in the orchard being heavily laden. Experiments were carried on in the thinning of the fruit on the standard varieties, the results of which are very striking, showing the great advantage of thinning. This is a phase of orcharding that is too frequently neglected in our State and this little experiment emphasizes the importance of it. A great many new varieties hitherto untested at this Station, fruited the past season and some have proven to be of especial value. We are now preparing a bulletin on the result of the last seson's work and these varieties will be described in detail. The diseases and insect pests in the orchard were completely controlled, there being almost no brown rot on any of the varieties, and only about one per cent. of the fruit stung by curculio. This shows how completely this disease and insect may be controlled when the orchards are properly sprayed.

Apples.—The four year old apple orchard in the new experiment grounds has made very satisfactory growth, but produced no fruit this season. By another year, the early fruiting varieties should begin to bear.

Pears.—The variety pear orchard was seriously injured this spring by blight, some varieties being killed entirely, while it was necessary to cut others back considearbly to save them. Our experiments to control pear blight by cultural methods has been continued, this being the fourth year. While practically all of the trees bloomed this season, there was only one plot that showed any signs of blight. This experiment is becoming more and more interesting each year, and we believe we will have valuable data for publication in the course of three or four years, but it will require a long period before we can draw any definite conclusions in regard to this important work.

Japanese Persimmons.—This division has been cooperating with the Department of Agriculture in growing the Japanese persimmons for several years. The Station has received practically all of the recent importations from the Department, some of which fruited very successfully during the past season, some of the individual specimens being three inches in diameter and of good quality. Unfortunately, a great many of the varieties were attacked this spring by what appears to be blight. This disease may prove to be very serious. As yet little is known in regard to it. It attacks the persimmon exactly the same way as the pear blight attacks the pear, except that it causes the leaves to drop immediately, while in the case of the pear, the leaves hang on after the twig has been killed. Some of the varieties appear to be immune or at least were not attacked this season. This disease, as far as we know, has not appeared on any of our native persimmons.

Plums.—The variety plum orchard planted last season, has made very satisfactory growth and should produce some fruit another year. In addition to the testing of varieties of plums we have planted the same variety on different types of soil and exposure.

Grapes.—Our variety test of the Rotundifolia or scuppernong type of grapes, has been continued. A number of new varieties originated within the last few years, have proven to be of special merit, being even more productive and of better quality than some of the old varieties. A report on this subject will be published as soon as practicable. Our pruning experiments with these grapes have also been continued and our work in Bulletin No. 132 verified. Our pruning work of last season, however, shows that vines one and a half inches or more in diameter, should be pruned before the first of November as we had serious bleeding from vines pruned as early as the fifth of November. We, therefore, recommend that the pruning of all grapes of the Rotundifolia type be commenced as soon as the leaves begin to drop and concluded by November 1st. Small vines may be pruned without serious injury as late as the first of December. Vines pruned in November, when the temperature ranges from 65 to 80 degrees will bleed profusely. This work will be continued another season as there are some points yet to be cleared up. Some varieties show a greater tendency to bleed than others and this phase of the work will be treated another season. Our experiments in different methods of propagating these grapes have also been continued and our results very satisfactory. This work will all be embodied in a bulletin which we wish to publish during the coming year.

Work Under the Adams Act.

Our experiments as outlined under Project No. 9 have been continued. This work will be carried on another season before making a detailed report. We have arranged to continue this work in the greenhouse and this will be of the greatest importance as it will greatly prolong the blooming period of these grapes and thereby afford more time for studying this problem.

Farmers' Institute and Extension Work.

During the last year, this division has done considerable Farmers' Institute work. In addition to this, representatives of the division have visited many of the rural schools throughout the State and assisted in the improvement of the school grounds. We have visited a large number of commercial orchards throughout the State, giving pruning and spraying demonstrations, as well as instructions in regard to methods of culture and marketing of fruits.

Respectfully submitted,
C. C. NEWMAN,
Horticulturist.

REPORT OF THE BOTANICAL DIVISION.

Clemson College, S. C. November 23, 1912.

Prof. J. N. Harper, *Director*,
Agricultural Department,
Clemson College, S. C.

Dear Sir:—I respectfully submit the following report for the Botanical Division of the Experiment Station for the fiscal year ending June 30, 1912. During the year the lines of investigation previously reported have been continued. In addition to these, several new projects have been taken up. A summary of each phase of the work is given below.

Cotton Anthracnose.

The cotton anthracnose investigation has been continued during the year along the same lines as heretofore, and in addition, several new phases of the life history and habits of the fungus have been studied.

Buried Bolls.—The second year's study of the vitality of the fungus in bolls buried at different depths in the soil in the field shows that the fungus does not remain alive in such bolls longer than May. Bolls were buried at different depths, ranging from two to ten inches. The fungus seemed to remain alive the same length of time at all of the different depths tested.

Fall Plowing.—In this same connection fall plowing was tested for the second season as a measure of control. The land selected for this test was in cotton last year and thirty per cent of the bolls were destroyed by anthracnose. One-half of this field was plowed in November with a disc to the depth of about ten inches, thus turning under all of the stalks and bolls. The other half of the field was left unplowed until planting time. The entire field was planted in the same way and with the same seed and at the same time, and was worked and fertilized the same. In the end of the field that was fall plowed there was no anthracnose at all. In the end not fall plowed, twenty-eight per cent. of the bolls were destroyed by the disease.

Kind of bolls from which it seems safe to select seed for planting.—One hundred and ninety bolls of cotton were selected from diseased stalks in the field last fall and were examined under the microscope and studied in the laboratory during the winter. Seed from these were germinated under sterile conditions and the amount of disease noted. The remainder of the seed from each boll were then planted in a separate plot in the field and from five to ten stalks grown to maturity from each boll. Seed from such of these bolls as appeared free from disease and which, upon microscopic examination, showed no spores or filaments of the fungus, developed anthracnose when germinated in the laboratory and when planted in the field. The same was, of course, true of definitely diseased bolls. Seed from other apparently healthy bolls taken from diseased stalks, but not examined produced, when planted on land which had not been in cotton for a long period of years, an abundance of anthracnose. The same thing was true last year, so that we are convinced now that it is not at all safe to plant seed from any kind of boll from a diseased stalk. Seed taken from healthy stalks continue to develop disease free progeny.

Laboratory and field tests with diseased seeds.—Samples of seeds were obtained from four fields visited last season in which anthracnose caused serious loss. These were studied in the laboratory during the winter, numerous centrifuge and germination tests made of them, and the amounts of disease noted. Some seeds from each of the four samples, together with some diseased seeds with definite history from the Experiment Station farm, were planted in the field this season on land which had never been in cotton. The results of these tests are not conclusive, but they are sufficiently encouraging to warrant the continuation of the investgation of a laboratory method of determining just how much anthracnose can be present in a given sample of seed without causing serious loss during a normal season when such seed is planted in the field.

Hulls from diseased seed as a factor in the distribution of the disease.—Cotton seed hulls from diseased seed were broadcasted on a piece of land which had never been in cotton and this land was then planted with seed which were considered free from disease. Considerable anthracnose developed on the cotton grown on this land this season. Centrifuge and culture tests showed the presence of live spores of this fungus in these hulls. This of course, is a one year's test and may not mean much, but it seems sufficient to warrant the continuation of this phase of the investigation.

Manure from cattle fed on diseased hulls as a factor in the distribution of the disease.—Hulls from the same lot as mentioned above were fed to dairy cows and the manure collected and broadcasted on land which was later planted in cotton. A small percentage of the bolls which developed on this plot this season showed disease. The conditions under which this test was made make us wonder, however, whether or not this disease came from the manure. Cultures made from this manure did not develop the fungus. This test will be repeated.

Survey of Anthracnose in the State this season.—From the information we have been able to gather the disease seems more prevalent in the State this season than heretofore. This has been especially true of some of the new varieties. The "Half and Half Cotton," a new variety sold for the first time on a large scale in this State, has been found diseased wherever planted. The gentleman who grows this seed writes me that he sold to between five and six hundred farmers in this State last spring. Every one of these farmers that we have heard from reports serious loss from anthracnose. In some cases they report seventy-five per cent. of the bolls in this variety destroyed. In the acre of "Half and Half" grown on the Experiment Station farm, forty-eight per cent. of the bolls, by actual count, were found destroyed. Several cases have been reported where Cook's Improved was badly diseased again this season. A further study of the histories of the cases observed bears out our conclusion that seed is the main source of infection.

A survey has been made in Darlington County of the amount of anthracnose in the staple cotton grown in vicinity of Hartsville and Darlington. Seventy-two farms, on which upland long staple cotton is grown, were visited and a total of 3,539 acres were gone over. The varieties of cotton grown on these farms were Keenan, Webber, Hartsville, and Columbia. The average amount of disease found in the different varieties is as follows:

Keenan on	47 farms	2,958 acres	2.8 per cent. of the bolls diseased.
Webber on	20 farms	502 acres	9.6 per cent. of the bolls diseased.
Hartsville	3 farms	64 acres	6.3 per cent. of the bolls diseased.
Columbia on	2 farms	15 acres	6.6 per cent. of the bolls diseased.

Many reports were received from other sections, of the prevalence of anthracnose in the staple cottons and a number of fields planted in Columbia, Keenan and Webber were visited by representatives of the office. It seems from our observation and from these reports that the staple cottons are diseased wherever grown. A summary of the Anthracnose Investigation was published in popular form as Bulletin 164 of the Station.

Cotton Shedding.

Beginning with last season we undertook a study of some phases of the physiology of the cotton plant with a view of determining, if possible, what factors cause cotton to throw off its buds and immature bolls during unfavorable seasons. That cotton shedding is an important factor in the production of cotton, is evidenced by the data collected during the past two seasons on the amount of shedding which takes place here on the Experiment Station farm. Counts made on individual stalks and on different plots during the past two seasons, show that the shedding here amounts to from forty to eighty per cent. of the buds and bolls formed.

We have made an effort during the past two summers to measure the physical factors which might influence shedding and have at the same time studied carefully a number of individual plants in the field. In this connection we have kept accurate records of the air and soil temperature, soil moisture, and air humidity, wind velocity, evaporation from an exposed water surface, evaporation from porus cups and by means of black and white cups have tried to get some data on amount and intensity of sunshine. The individual plants were studied from day to day and their activities compared with the physical factors under consideration. We worked out a system of determining the leaf area of individual cotton plants and used this in computing the leaf area of a large number of plants grown under different conditions and plants of different varieties of cotton with a view of finding whether or not there is any relation between leaf area and shedding or leaf area and yield. We are also growing some selections from stalks of high and low shedding records last year, with a view of determining whether or not shedding is inherited.

We have quantities of data on these different phases of the problem, but do not yet feel warranted in publishing anything. One fact might be mentioned here, however, which seems pretty clearly indicated from the two seasons' work, and that is that soil moisture is one of the most important factors, if not the most important factor, in the cause of cotton shedding.

Forestry Experiments.

In January of the present year we entered into an agreement with the Forest Service of the United States Department of Agriculture to co-operate with them in conducting experiments at the Summerville Sub-station relative to the success and feasibility of artificial reforestation of that section with native pines, such as longleaf, loblolly, and shortleaf pines, and the introduction on the Atlantic coastal plain of maratine pine, cork oak, and other exotic tree species. This is a very important experiment and one which should, in the future, mean a great deal to the entire eastern section of the State in as much as it will have a direct bearing upon the problem of the best utilization of the large tracts of cutover lands in the entire coastal region of the State.

The work was begun in February. A tract of 12.6 acres in the northwest corner of the Station lands was set aside for this purpose, was enclosed in a good fence, and protected by fire lines. During the months of March and April of the present year plots of this land were seeded to loblolly, shortleaf, and maratine pines and cork oak. Other seedings will be made during the coming fall and winter. This is a very important work and one that should be encouraged in every way.

Cotton and Cowpea Wilt Work.

This work, which is being carried on in co-operation with the Bureau of Plant Industry of the National Department of Agriculture, has been continued along the same lines as heretofore. About 300 bushels of wilt resistant seed were sold through this office to farmers whose fields are infected with this disease. Besides the seed sold by us, quantities were sold by some of the breeders themselves. At least 1,000 acres were planted this past season in seed grown by these co-operative breeders under the supervision of this Division. The breeding phase of this work looks especially promising at this time. Many of the stalk selections made last year have shown up remarkably well in progeny rows this season, and we are looking forward with a great deal of interest to the planting of these in increase plots under field conditions next season.

Variety tests were conducted at Bennettsville, Dalzel, and Williston this season with a view of determining the comparative resistance of the different varieties of cotton to wilt. From these we have obtained valuable results which can be used to advantage in planning experiments of similar nature in the future. At these three places Yokahama velvet beans and different strains of cowpeas were also planted with a view of obtaining information relative to the best legume for use on wilt and root knot infested lands.

In co-operation with the Extension Division and the Farm Demonstration Agents, we are making a survey of the distribution and prevalence of wilt in the eastern section of the State. We hope in this way to add to our present knowledge of the distribution of the disease.

Aside from the supervision of the breeding work, the variety tests, and the survey work, Mr. Watson has devoted some time to assisting Mr. W.W.Gilbert, of the Bureau of Plant Industry, in the breeding and hybridization work with the resistant cottons and cowpeas at Florence and Monetta, and has spent a month in Washington in the laboratories of the Office of Cotton and Truck Diseases assisting with the laboratory end of this investigation. He has also assisted the Extension Division of the College in holding farmers' institutes through the wilt infested section of the State. It is hoped that as soon as work is well under way at the Pee Dee Station at Florence we will be able to carry some of the more important phases of this work there where we can have direct supervision of it at all times.

Pathological Inspection.

Since the passage of the South Carolina State Crop Pest Commission Act and the organization of the Crop Pest Commission, the duties of State Pathologist have evolved upon the writer. So far we have endeavored to get the work organized and to get such rules and regulations adopted as will insure protection to the farmers of the State with the least possible amount of inspection. One of the special features in which we are very much interested at present is the enforcement of rules and regulations governing the sale and transportation of diseased seed within the State. We are making a sperial effort in this connection to prevent the sale or transportation of diseased seed of the staple crops.

This is a very important work and one which, it seems, will fit in well with the investigation work which we have under way.

Respectfully submitted,
H. W. BARRE,
Botanist and Plant Pathologist.

REPORT OF ENTOMOLOGIST AND ZOOLOGIST.

Clemson College, S. C. October 25, 1912.

Prof. J. N. Harper, *Director.*
South Carolina Experiment Station.

Dear Sir:—I herewith submit the report for the Division of Entomology and Zoology for the fiscal year ending June 30, 1912.

The following projects under the Adams funds are in progress:

Project No. 2.—The relation of temperature-moisture to insect activity.

Nearly all the laboratory work on this subject is carried on at the main laboratory at Clemson College and this is supplemented by field investigations at the Marion field laboratory in the eastern part of the State, and the Colleton field laboratory in the southern part of the State. At Marion the investigations are confined almost entirely to the cotton root louse, *Aphis maidiradicis,* and in the southern part of the State to the wire-worm, including *Horistonotus curiatus* and several species of Cardiophorus.

The field investigations show that temperature-moisture have a direct influence on the activities of the cotton root louse. The records are being prepared and together with those of last year (which were purposely withheld) and published a Station bulletin.

The work at Clemson during the past fiscal year was devoted mostly to the originating of apparatus for the control of moisture and temperature. The mechanical part of the work has been developed by Prof. Styles T. Howard of the Mechanical Engineering Department, and while his services for the most part are voluntarily, excellent progress has been made. We have good prospects that the apparatus will be in operation before the beginning of hibernation this fall.

The purpose of this apparatus for the control of temperature and moisture has been explained in a previous report and also in Bulletin 155 of this Station. While we have apparatus for reliable temperature control, we met many difficulties when attempting to control the moisture also.

Slender Wire-worm.

This project has made satisfactory progress notwithstanding the difficulties involved in prosecuting the investigation. The pupae and adults of the several species of wire-worms were bred and contrary to all expectations, it appears that other species besides Horistonatus curiatus are destructively abundant. Every effort is being made at present to clear up this point.

Co-Operative Experimental Work.

The following lines of work were prosecuted under co-operative experimental work:

The investigation of the cotton root louse, *Aphis maidiradicis*. The problem, as heretofore, is continued in co-operation with the Section of Southern Field Crop Insects of the Bureau of Entomology, Mr. Thomas continuing in charge of the problem.

A large series of field experiments with repellents and cultivation were carried out and a large amount of valuable scientific information was obtained. As previously stated the records will be issued as a bulletin this winter.

Co-Operative Experimental Orchard Work.

The co-operative experimental orchard work was continued and the result exceeded those of the preceeding year. The work consisted of testing of pumps for various purposes in this State and also the spraying of orchards and shade trees.

During the past season comparative tests of a large number of different makes of barrel pumps were made and these results together with those obtained in co-operative spraying will be issued as a bulletin this fall.

Insectary.

The insectary of this Division was moved to a very desirable room in Agricultural Hall and has the temperature mosture room adjoining it. A large amount of new apparatus has been procured and we have better accommodations for this branch of the work than heretofore.

Collections.

The collections are being mounted in standard Shmitt boxes and the progress made in this branch of the work is very satisfactory.

Personnel.

Prof. W. P. Gee, Assistant Entomologist, resigned August 1 to accept a research fellowship in the University of California. The position has been filled by the appointment of Prof. M. P. Somes of Minnesota. Mr. J. A. Riley, graduate assistant, has entered the University of Wisconsin and this position has been accepted by Mr. N. K. Rowell, a graduate of this College in the class of 1911.

Correspondence.

Much of the writer's time is consumed in general office work. Entomology in recent years has made enormous progress, especially in the South, and owing to the many intricate details, efficient clerical service is necessary. This is a serious weakness and if this is not properly provided for, then certain important work must be discontinued or the Division will arrive at a point when it can only "mark time." This is the weakest point in the work of the Division and the writer's efforts in remedying it are well known.

Miscellaneous.

Owing to the continuous demands on the Division, a certain amount of miscellaneous experiment work is necessary. This work is merely to meet emergencies when it can be done without interfering with regular problems. Among the miscellaneous experiments are the investigation of doubtful points in the control of corn weevils, pea weevils, Harlequin cabbage bug, gloomy scale, purple scale on fig, and others.

The writer wishes to express to you his appreciation for your interest and assistance in carrying out the work.

Respectfully,
A. F. CONRADI,
Entomologist.

REPORT OF CHEMIST.

Clemson College, S. C., December 3, 1912.

Prof. J. N. Harper, *Director,*
South Carolina Experiment Station.

Dear Sir:—I respectfully submit the following report for the past fiscal year, ending June 30, 1912.

Work Under the Adams Act.

Two main lines of research have been pursued during the past year under the Adams fund. The first is relative to the toxicity of cotton seed meal and the details of the plan of this work are enumerated under projects Numbers 4, 5, and 12. This work has been prosecuted in co-operation with the Division of Animal Husbandry, with the exception of problem No. 12, which is entirely a chemical phase. We have completed two sets of extracts which have been fed to hogs and some interesting observations made. This work is being continued as rapidly as possible.

Project 17.—A Study of the Cause of the Partial Insolubility of Potash Salts When Mixed with Basic Slag.

This work is nearing completion and we are in position to make a preliminary report on this project. In the spring of 1910 we made a number of mixtures on the farm of Mr. W. C. Brant, in Colleton County. The object of this experiment was to ascertain how thoroughly mixing can be done under farm conditions. Two mixtures were made of each formula: in one acid phosphate was used as the source of phosphorous; and in the other basic slag was used as the source of phosphorous. A sample was taken from each mixing and these samples were later analyzed. The materials used for mixing were also analyzed and the theoretical analysis compard with the actual result. No account was taken, at this time, of the small percentages of potash carried by the sources of phosphorous.

The mixtures made with acid phosphate as a source of phosphorous showed an actual analysis of within one-tenth of one per cent. of theory. These results are reported in Bulletin No. 151. The analyses of the mixtures that contained basic slag as a source of phosphorous analyzed from 1.0 per cent. to 1.9 per cent. below theory.

An investigation was planned this year to determine whether a compound insoluble in water was formed or whether the seeming insolubility was due to an error of our method of analysis. In the beginning of this work we made use of strong solvents, such as hydrochloric acid, but found results very close to those given by the water soluble. On the supposition that the large iron precipitate might occlude some potash, this precipitate was redissolved, reprecipitated, and 0.39 per cent. of potash was found in the filtrate. The following procedure was then carried out:

Two and one-half grams of material was placed on nine cm. 589 papers previously fitted in funnels, then washed with boiling water to volume of 250 cc. 100 cc. equivalent to one gram of material was made alkaline with ammonia, brought to a boil, filtered, and washed. Lime was determined in the filtrate and the per cents. recovered indicated that the potash was not made soluble by an exchange of potash for lime; in which case, where muriate of potash was the source, the lime would have been present as calcium chloride,—a most soluble salt. Potassium oxide was determined in the filtrate from the lime precipitation. In evaporating these filtrates there is a decided tendency to crawl, but I found that by adding a small quantity of one to one sulphuric acid and only filling dishes to within about a quarter of an inch of the tops that this could be controlled. The burning off was also accompanied with difficulties on account of the large amount of residue and the danger of spurting, this operation had to be conducted with extreme caution.

The residues from washing with boiling water were transformed to digestion flasks, with ground glass necks carrying long condensation tubes. These residues were treated with 1.115 Sp. Gr. hydrochloric acid and kept in boiling water bath for ten hours. They were filtered by decantation into 500 cc. flasks, the remainder diluted and filtered on nine cm. 589 papers, the residue being washed thoroughly with hot water.

100 cc. of each filtrate , corresponding to one-half gram of material was diluted to about 200 cc. and precipitated with ammonia and brought to boiling, giving a very heavy precipitate. The precipitates were washed two or three times with hot water, the filtrates placed on water bath to evaporate and the precipitate redissolved in smallest possible volume of hot dilute hydrochloric acid, the filter thoroughly washed with hot water, making total volume about 200 cc., the solutions were again made alkaline with ammonia and brought to boiling, then filtered and washed as before, the filtrate being added to the one already evaporated. This operation was repeated once more making three precipitations and giving about six hundred cubic centimeters of filtrations and washings. When these filtrates were evaporated to about 100 cc. a small volume of one to one sulphuric acid was added and the evaporation continued to dryness in platinum dishes. The ammonia precipitates on the filters were redissolved, the filters washed with hot water and diluted to double the volume formerly used, about 400 cc. this time. A second reprecipitation was made in the same volume and the two filtrates combined and evaporated as in preceding cases. The dry residues in the platinum dishes were carefully burnt off and potash determined. Much more potash was found in the later, but more dilute precipitations as will be shown by the table that is to follow. A third set of the two reprecipitations of the iron precipitate, using a volume of about 400 cc. was now made and in no case did the potash exceed one tenth of one per cent. These reprecipitations will be continued until no potash is found.

The residues insoluble in hydrochloric acid were saturated with sulphuric acid and the filter papers destroyed and burnt off. They were then taken up with a few drops of sulphuric acid and a large volume of hydrochlo ric as described by Blair*. The evaporation was carried to dryness and taken up with dilute hydrochloric acid. The insoluble residues did not amount to as much as .05 per cent. in any case. The filtrates were made to 250 c.c. and 100 c.c., equivalent to one gram taken, diluted to large volume and made alkaline with ammonia, giving a rather heavy precipitate of iron, these determinations were brought to boiling and filtered and washed, as previously described, the iron precipitate was dissolved and reprecipitated and the two filtrates combined and potash determined therein; a third reprecipitation was made, but in no case did this filtrate yield as much as .01 per cent. of potash.

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*The Chemical Analysis of Iron, page 273.

The following table summarizes the above described work:

	Per cent Water.	Per cent. Water Soluble.	Per cent. soluble 1.115 Sp. Gr. HCl.	Per cent. Soluble HFl.	Per cent. insoluble.	TOTAL	Per cent. water Soluble Potash K2O.	1, 2, and 3 precipitation in small volumes—HCl filtrates	Fourth and fifth precipitations in large volumes—HCl filtrates.	Sixth and seventh precipitations in large volume HCl filtrates.	Occluded by lime one reppt.	First and second precipitation. Soluble in HFl.	Third precipitation. Soluble in HFl.	Total K2O recovered.	Theoretical K2O.	K2O Insoluble in H2O Determined.
	1.71	6.64	78.05	13.57	0.03	100.0	4.00	0.25	0.69	0.07	0.08	0.05	0.00	5.14	5.77	1.14
1214	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	1.37	12.07	72.46	14.08	0.02	100.0	2.60	0.39	0.22	0.08	0.09	0.03	0.00	3.41	3.60	0.81
1216	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	1.95	5.76	84.69	7.56	0.04	100.0	1.71	0.26	0.41	0.08	0.09	0.09	0.004	2.64	3.00	0.93
1218	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	0.51	11.75	75.13	12.57	0.04	100.0	4.55	0.10	0.85	0.09	0.02	0.06	0.00	5.67	5.70	1.12
1220	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

1.—These results show that a part of the potash which when unmixed is soluble in water, becomes insoluble when mixed with basic slag.

2.—A determination of the water soluble lime content before and after mixing indicates that there is no interaction between calcium and potassium.

3.—By elimination, it appears that there must be a combination in which the iron and potash are involved.

4.—The compound is insoluble in hot water, but almost entirely soluble in hydrochloric of 1.115 Sp. Gr.

5.—When the compound is dissolved there is so much iron present that it occludes the potash to such an extent that it is necessary to use large dilutions and many reprecipitations to separate the potash.

We will continue this investigation to determine the solubility of the hot water insoluble potash in ammonium citrate and in citric acid. This occlusion of potash by iron will, probably, account for the complaint so often heard from the mixers that certain mixed goods do not show the amount of water soluble potash that they should and do in other cases.

We are going to investigate further to determine if there is any relation between the iron content and the content of potash insoluble in water, in certain mixtures of acid and potash that were found deficient by our Fertilizer Control during the past year. It is a well known fact that the Tennessee rock runs much higher in content of iron and alumna than does the Carolina rock, also there is considerable variation in the rock at the mines.

Other Work.

The study of the changes in composition of the oat plant at different stages of development, has been completed and the results published in Bulletin No. 163 of this Station, which is made a part of this report. This work was done in co-operation with the Division of Agronomy. In continuation of this work we are studying the influence of certain nitrogenous manures on the oat plant.

This work is near completion and will be reported at an early date. Certain legumes are being studied in reference to their nitrogen collecting powers, and this work is also in combination with the Division of Agronomy.

The work on the sweet potato has been reported in Bulletin No. 165 which is made a part of this report, and the sweet potato work for the present has been dropped.

The fertilizer field tests are being continued along the following lines:

1.—Determination of plant food requirements of soils under experiment both in rotation and when planted continuously to cotton.

2.—Determination of the proper relation of nitrogen to phosphoric acid in the Piedmont region.

3.—Determination of the relative availabilities of our common sources of nitrogen.

4.—Determination of the relative availabilities of some doubtful sources of nitrogen.

5.—A study of top dressers.

6.—Comparison of acid phosphate, basic slag, and floats as sources of phosphorus.

We have perfected a scheme of keeping records of our plot results which will facilitate this work a good deal.

Publications.

Bulletin No. 163, "A Study of the Changes in Composition of the Oat Plant as it Approaches Maturity," (in co-operation with the Division of Agronomy.)

Bulletin No. 165.—"Sweet Potato Investigation."

Farmers' Institute Work.

About two weeks of the past year was devoted to Farmers' Institute work in the lower section of the State.

Respectfully submitted,
T. E. KEITT,
Chemist.

REPORT OF SECRETARY AND LIBRARIAN.

Clemson College, S. C., December 7, 1912.

Prof. J. N. Harper, *Director*,
South Carolina Experiment Station,

Dear Sir.—Below will be found the report of the Secretary and Librarian of the South Carolina Experiment Station for the fiscal year recently closed, June 30, 1912.

Measured by the standard of a growing desire to succeed, and animated by the creditable impulse of surpassing former efficiency in the distribution of scientific truths to the farmers of the State, the workers in the Secretary's office in pursuit of his instructions and in co-operation with him, have well nigh, if not quite, maintained an unbroken activity in the prosecution of this one important line of work, from the beginning of the fiscal year, down to the present time.

Seven bulletins have been published and sent out under the supervision of the Secretary in editions of 18,000 copies. These represent various lines of interesting work. Their subjects are usually significant of their contents. The subjects are: "Experiments With Varieties of Cotton," "Home Gardening in South Carolina," "The Bud-worm of Corn," "Changes in the Composition of the Oat Plant as it Approaches Maturity," "Cotton Anthracnose," Sweet Potato Investigation," "Reclamation of Crawfish Lands." The bulletin containing the analyses of commercial fertilizers was sent out under the frank of the Experiment Station.

Three circulars were issued of the following lines of work: "Home Mixing and General Fertilizer Formulas," "Results of Co-operative Experimental Work for 1911," "Ticks and How to Destroy Them."

Seventeen press bulletins containing analyses of commercial fertilizers were mailed from this office. These bulletins supplied the farmers with a definite knowledge of the contents of the fertilizers before their purchase was made. Providing the analyses of the samples of fertilizers as rapidly as they were sent in from January until May, is a guarantee of protection to the farmers.

The regular bulletins, circulars and press bulletins made up 452,000 mail packages to be handled, approximately a half million.

Besides this, the current requests for the bulletins of this station have exceeded all expectations, and they have gone far beyond the limits of all former experiences.

The mailing list is kept comparatively new by the strictest attention to erasures, when they are needed, and additions when requests for them are made. We have a large constituency of bulletin readers in this State. They manifest considerably more than ordinary interest in studying and applying to their eminently useful work, the scientific facts contained in our publications. Their ranks have been depleted by several hundred during the past year—due to the causes of removals and deaths. Our mailing list, however, continues to grow. Twelve hundred new accessions have been added to it, in the time of the fiscal year, recently closed.

The Secretary of the Experiment Station is also the librarian of the Station Library. It is gratifying to report that a fairly creditable number of technological books have been added to our resources along this important line of equipment during the year past. Fifty-four volumes of bulletins have been bound and placed on our shelves. Many other pamphlets on cognate subjects and material, have been put in more permanent form by the binder for the protection of the interests of the library. It requires constant vigilance to maintain the custody of the bulletins contributed to the library by the various Experiment Stations throughout the country. To prevent their illicit abstraction from the library collection, is a task of some difficulty.

Our efforts to secure a complete file of all the bulletins issued by the stations of other states and territories have been well nigh crowned with success. If there are any absent from our files, the paucity of the missing ones does not amount to much. There are now approximately 700 bound volumes of bulletins on our shelves. They constitute the fundamentals of agricultural attainment and they stand out as the crown and culmination of the work of our scientific experts during the irrevocable past.

Respectfully submitted,
J. N. HOOK,
Secretary and Librarian.

REPORT OF ASSISTANT TO AGRONOMIST.

Clemson College, S. C. December 13, 1912.

Prof. J. N. Harper, *Director,*
South Carolina Experiment Station.

Dear Sir:—The experiments of the Agricultural Division being conducted under the Hatch fund are as follows:

1.—Experiments to determine the best paying system of rotation of crops with a view of keeping up the fertility of the soil, cotton being one of the main crops.

The Station is continuing these experiments uninterruptedly, special areas being kept in reserve fr these tests, which consist of two, three and four year rotations. The last published data on this work was in Bulletin No. 145. Other publications will follow as soon as enough data has been filed.

2.—Experiments to determine the best variety of cotton best suited to the different soil types of the State.

This work is being done in co-operation with a number of farmers of the State. The Station furnished seed to about 150 farmers last spring for continuing this experiment. One bushel each of two different varieties of cotton was sent to each co-operator, the Hartsville variety being used as a check. Reports will be received on the results of these tests, and the data so obtained published. The varieties now being tested are Hartsville, Triumph, Wannamaker's Covington Toole, Summerour's Half and Half, Columbia, Hope's Improved Mexican Big Boll, Wannamaker's Cleveland Big Boll, Cook's Improved, Hite's Early Prolific, and Webber. A sample of each variety grown by the different co-operators will be tested for the strength of fibre and length of staple.

3.—The breeding of cotton with the view.
  (a) Increasing the yield.
  (b) Resistance to disease.
  (c) Increasing the length of fiber.
  (d) Increasing the size of the bolls.

Varieties which originated on the Station farm are being used for this work. Selections are being made each year for improving the varieties as to yield, length of fibre and size of boll. One variety which has been subject to rigid selection deserves special notice here. It was originated from the Blue Ribbon variety which was a cross between the Allen long Staple and the Dickson. Through careful and rigid selection this cotton has been improved to where the bolls are large, and the length of fibre has been increased considerably. Originally the bolls were not more than from four inches to four and a quarter inches in circumference, now they are from five to five and a quarter inches in circumference. The length of fibre has been increased from about one and one-sixteenth inches to from one and one-fourth to one and five-sixteenth inches. As this cotton was a hybried, it will take a few years more of careful work to so fix the type that it can be distributed among the farmers.

4.—The breeding of corn with the view.
- (a) Increasing the yield.
- (b) Obtaining a smaller, stronger stalk.
- (c) Uniformity of ripening.
- (d) Uniformity of ears.

Lee County and McGregor are the varieties being used in the test, and careful selection is being made each year.

5.—A comparison of the Williamson plan and two other methods.

6.—A test of various forage crops and cereals, such as Pearl Millet, German Millet, White Kaffir Corn, Amber Sorghum, Broom Corn, Canada Field peas, oats, wheat, and barley.

The following varieties of these crops were tested this year:-Pearl millet, German millet, White Kaffir corn, Red Kaffir corn, teosinte, Early Orange sorghum, Broom corn, and selections of oats, wheat, rye, and barley.

Soybean varieties:—Mammoth Yellow, Hollybrook, Brown Soja, and Early Dwarf Green Soja.

Varieties of Cowpeas:—Peerless, Ramshorn, Coffee Pea, Valivant, Wild Goose, Black, Black Eye, New Era, Clay, Red Ripper, Iron, Whippoorwill, Brabham, and Unknown.

In addition to these a test was made of the Velvet bean and the Yokahoma Velvet bean, a new variety, seed of which was obtained from the U. S. Department of Agriculture. Both plants are very similar, the Yokahoma bean, however, matured seed, while the Velvet bean did not.

7.—Experiments on different methods of sowing grains at different times.

Sowing grain about October 1st has given the best results as this insures a more uniform distribution of the seed, and enables the plants to become firmly established before freezing weather comes.

8.—Experiments on sowing alfalfa at different times of the year and by different methods.

Alfalfa should be sowed in the fall of the year, at least one month before freezing weather, as this allows the plants to become established and enables them to withstand the cold of winter better, and they can get an early, vigorous start in the spring, and so get ahead of weeds and grass which will be almost sure to get ahead of the young plants if sowing is done in the spring.

9.—Experiments to determine the value of inoculating bur clover, alfalfa and vetch.

Inoculation experiments with alfalfa have proven successful, and necessary to good growth. Uninoculated alfalfa was a failure.. Farmogerm was used with success on alfalfa. If the seed of bur clover is planted in the bur, no inoculation will be necessary as there is enough bacteria on the burs of the seed to insure sufficient inoculation. Inoculation for vetch is necessary in most cases for good results. Further tests with these crops are being made.

10.—Experiments to determine the best legume to plant in cotton as a catch crop, bur clover, vetch, and crimson clover being used.

Excellent crops of bur clover can be obtained in cotton if the season is not too dry. A moist season is essential to good results with these crops. Continued dry weather after the seed has sprouted results in very poor results, if not a failure. Early plantings give the best results.

11.—Tests of methods of curing alfalfa hay.

12.—A study of the fertility of the soil as influenced by its physical condition.

13.—Experiments to determine the best time to apply fertilizer to oats.

14.—Variety tests with wheat, corn, alfalfa, vetch, cowpeas, sweet potatoes, and cotton.

The Station has thirty varieties of wheat to be tested this fall, our tests last year consisting of several varieties which were specially selected for improvement. This feature of the work will be continued. Lee County, McGregor, and Williamson were the varieties of corn tested this year. Experiments with alfalfa are being continued. The Hairy vetch had proved to be better adapted to our soils than the English vetch which is in many cases winter killed, quite a number of different varieties of cowpeas, named above, were tested, but the unfavorable weather conditions will not permit of a report until a duplicate test has been made. About twenty-five varieties of cotton are being tested on the farm this year. These are Gondola, Brabham Long Staple, Wannamaker's Cleveland Big Boll, Wannamaker's Covington Toole, Summerour's Half and Half, Carpenter's Columbia, Haaga No. 2, Haaga No. 3, Franklin's Prolific, Hope's Improved Mexican Big Boll, Hartsville, Spring Grove, Edgefield, Blue Ribbon, Felkel, Crawford's Improved Big Boll, Sugar Loaf, Donaldson's Big Boll, Alabama Station Cook, Roger's Big Boll, Cook's Perfect Big Boll, Cook's Early Double, Wannamaker's Big Boll, Triumph, and Experiment Station No. 2.

15.—A test of the various methods of cultivating cotton by the entire use of machinery.

Adams Fund.

1.—The effect of pollen from barren stalks on the yield of corn.

This experiment has been under way since 1908, but little detriment to the corn has been noticeable by fertilizing it with pollen from barren stalks. The ears have a tendency to come out higher up on the stalks.

2.—A study of the relation that exists between the soil types and the length of the fiber of cotton.

This work is being done in co-operation with a number of farmers of the State, and samples of cotton from each grower will be tested for the length and strength of fiber. The Hartsville variety is being used for this test.

3.—Studies to determine the relation that exists between the moisture evaporated by plants and the amount of nitrates in the soil.

(In co-operation with Botanical Division.)

4.—A study to determine the influence of different types of soil on the composition of certain plants.

(In co-operation with the Chemical Division.)

Very truly yours,

F. G. TARBOX,

Assistant to Agronomist.

35

TWENTY-SIXTH ANNUAL REPORT

—OF THE—

South Carolina
Experiment Station

—OF THE—

Clemson Agricultural College

For the Year Ending

June 30, 1913

TWENTY-SIXTH ANNUAL REPORT

—OF THE—

South Carolina Experiment Station

—OF THE—

Clemson Agricultural College

For the Year Ending

June 30, 1913

The Printery. Clemson College, S. C.

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Summerville, S. C.
R. E. CURRIN, Supt. of Pee Dee Expt. Station, Florence, S. C.
BURNS GILLISON, Foreman of Experiment Station Farm.
MISS HELEN C. BRADFORD, Stenographer.

Mail and Telegraph: Clemson College, S. C.
Freight and Express: Calhoun, S. C.

The Bulletins of the Station are issued at irregular intervals, and are sent free to all citizens of the State who apply for them.

LETTERS OF TRANSMITTAL

Clemson College, S. C., December 1, 1913.

Hon. Alan Johnstone, President Board of Trustees, The Clemson Agricultural College.

Dear Sir:—I beg to submit herewith the Twenty-sixth Annual Report of the South Carolina Agricultural Experiment Station, which in accordance with the law, must be submitted to the Governor on or before February 1, 1914.

Yours very truly,
W. M. RIGGS,
President.

Clemson College, S. C., December 1, 1913.

Hon. Coleman L. Blease, Governor of South Carolina.

Sir:—I have the honor to submit herewith the Twenty-sixth Annual Report of the South Carolina Experiment Station in accordance with the requirements of an Act of Congress, approved March 2, 1887, for the establishment of Agricultural Experiment Stations in connection with the colleges of the several States, organized under the provisions of an Act approved July 2, 1862.

Respectfully submitted,
ALAN JOHNSTONE,
President Board of Trustees.

ANNUAL REPORT OF DIRECTOR OF SOUTH CAROLINA EXPERIMENT STATION

Clemson College, S. C., July 8, 1913.

Dr. W. M. Riggs, President,
Clemson College, S. C.

Dear Sir:

I have the honor of submitting herewith a brief report of the work of the South Carolina Experiment Station for the fiscal year ending June 30th, 1913.

During the year a number of the members of the Station Staff rendered assistance to the Superintendent of the Extension Division in conducting institutes in various parts of the State, and the Station in co-operation with other departments of the College made a splendid exhibit at the State Fair last autumn and at the National Corn Exposition this past spring.

The co-operative work with the Department of Agriculture in a number of experiments has been continued. During the year we have not added any new Adams projects and most of the work is a continuation of that planned a number of years ago.

Horticultural Division.

The work of the Horticultural Division has been mainly with the Rotundifolia grapes. The object of the experiment is to determine whether or not varieties of this type are self sterile. These experiments have progressed most satisfactorily.

This division has also conducted experiments with the following: Variety tests of bunch grapes, apples, peaches, Japanese persimmons, blackberries, raspberries, strawberries, okra, tomatoes, Irish potatoes, etc. During the year the Horticultural Division distributed a considerable quantity of seed of the variety of okra developed by the Division.

Entomological Division.

The Entomological Division has continued its work at the Marion Field Laboratory in studying the ravages of the cotton root louse. Splendid results have been obtained from these experiments. The most complete life history of this insect ever worked out has been accomplished at this laboratory. The planting of rye and vetch as cover crops last fall was unusually successful and acted as a most thorough cleanser on the cotton root louse infested fields and the results obtained thus far have been most valuable.

In working out the life history of the wire-worm at the Colleton Laboratory, considerable information has been obtained. This insect does considerable damage on the corn in that region. A simple method has been worked out for preventing the ravages of this insect. This Division is spending much time in perfecting an apparatus to be used in determining the importance of moisture in the activity of insects. This piece of apparatus is now being used satisfactorily.

Experiments have been conducted for the control of the gloomy scale, which is a great pest on maple shade trees in the State, and considerable experimental work has been done with the cowpea pod weevil, peach tree borer, and a number of other destructive insects.

Botany Division.

The splendid work of the Division of Botany with cotton anthracnose has been continued and this work is now about completed. During the past year considerable attention was devoted to the kind of bolls which produce diseased seed and the botanist has accumulated considerable data to show that it is not at all safe to select seed for planting from cotton stalks which contain any disease at all. New laboratory methods for detecting the presence of the disease were discovered.

A plant disease survey was made of the anthracnose in staple cotton in Darlington County last year. This survey covered 3539 acres and included about 75 farms. A full report of this was included in the Crop Pest Commission report.

A cotton shedding problem is now well under way. Last year's results indicate that water is the principal factor to be considered.

The forestry experiments which were started at the Coast Station last spring have been continued and we now have practically all of the ten acre tract planted.

The cotton wilt work which is being carried on in co-operation with the Bureau of Plant Industry has been continued along the same lines as before. The farmers in the communities in which this work is being conducted are taking an active interest in it and seem very much gratified with the results which we have been able to obtain. During the past winter and spring all of the pedigreed seed grown by the co-operative breeders in the different counties of the wilt section were sold. There was such a demand for these seed it was a hard matter for some who desired them to secure them. One of the varieties, Dixie, has been considerably improved by selection. The plantings this season on the farms of the co-operative breeders are larger than heretofore and it is the desire of the botanist to grow enough seed to supply the demand. The plant breeding work connected with this wilt work is especially promising. Many of the stalk selections made year before last showed up remarkably well in progeny rows last season, and seed from these are now planted under field conditions. In this same connection the work with cowpeas and with the Yokohama velvet bean has been both interesting and profitable. The control of cotton wilt would be impossible without some legume as velvet beans or cowpeas, some varieties of which are resistant to root knot. In this work several new strains of pedigreed cowpea seed are being used.

Division of Chemistry.

The Division of Chemistry has just completed a most valuable piece of work. The chemist has discovered that when either muriate of potash or kainit is mixed with basic slag a part of the potash soluble in water before mixing is rendered insoluble. This insolubility is due to the formation of a compound insoluble in water but almost entirely soluble in hydrochloric acid of specific gravity 1.115. This is an Adams project and the complete report of this work will be given in a bulletin.

Considerable progress was also made in this division on the Adams problems of determining the cause of the poisoning of hogs by the feeding of cotton seed meal.

Agronomy Division.

The work of the Agronomy Division has been mainly in testing something like thirty varieties of wheat and a number of varieties of oats, barley, rye and a great number of varieties of corn and about thirty varieties of cotton. The Station has now a variety of cotton developed here that is superior to any of the long staple varieties.

Our work in corn breeding is being continued with more or less success.

The rotation and fertilizer experiments inaugurated several years ago have been continued.

Animal Husbandry Division.

The work of the Division of Animal Husbandry to determine the physiological and pathological effect of feeding large amounts of cotton seed meal to cows begun several years ago has been changed slightly. At present eight cows are being used in the experiment, four of which are being fed cotton seed meal alone as a concentrate, while the balance are given wheat bran as a concentrate.

The experiment to determine the effect of cotton seed meal poisoning in hogs has also been continued. The prime object of this experiment at present is to test the toxicity of various cotton seed meals and to determine if there is any resistance to meals shown by different breeds of hogs.

During the year the Station has issued four bulletins in editions of 18,000 copies. The subjects were as follows:

"Hog Cholera and Its Control," by Dr. M. Ray Powers.

"Feeding Beef Cattle in South Carolina," by Prof. Archibald Smith.

"The Corn Weevil," by Prof. Wilson P. Gee.

"Analyses of Commercial Fertilizers," by Mr. H. M. Stackhouse.

The last named bulletin contains the analyses of commercial fertilizers and was sent out under frank of the Experiment Station, but was not paid for by the Station.

Six circulars were issued along the following lines of work:

"Some Results of the Boys' Corn Club Work in South Carolina," by C. B. Haddon of the Extension Division.

"Home Mixing and General Fertilizer Formulas," by W. B. West of the Fertilizer Control Division.

"Lime for South Carolina," by T. E. Keitt.

"Home Mixing of Fertilizers," by J. Coke Rampley, Division of Fertilizer Control.

"Variety Test with Cotton, 1912," by F. G. Tarbox, Jr.

"Silos and Silage Catechism," by R. H. Mason, Dairy Division, U. S. Department of Agriculture.

Respectfully submitted,
J. N. HARPER,
Director.

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION IN ACCOUNT WITH THE U. S. APPROPRIATIONS, 1912-1913.

Dr.	Hatch Fund.	Adams Fund.
To balance from appropriations for 1911-1912		
Receipts from the Treasurer of the United States, as per appropriation for fiscal year ended June 30, 1913, under Acts of Congress approved March 2, 1887 (Hatch Fund,) and March 16, 1906 (Adams Fund)	$15,000.00	$15,000.00

Cr.	Abstract.		
By Salaries	1	$8,315.91	$8,186.69
Labor	2	3,062.06	3,421.18
Publications	3	762.82	......
Postage and stationery	4	89.55	89.39
Freight and express	5	74.49	51.49
Heat, light, water and power	6	121.94	57.40
Chemicals and laboratory supplies	7	77.89	229.27
Seeds, plants, and sundry supplies	8	341.47	511.69
Fertilizers	9	529.05	595.77
Feeding stuffs	10	838.02	1,071.97
Library	11	198.08	49.58
Tools, machinery, and appliances	12	307.07	193.87
Furniture and fixtures	13	172.73	28.06
Scientific apparatus and specimens	14	23.80	372.93
Live stock	15	26.00	......
Traveling expenses	16	39.12	62.03
Contingent expenses	17	20.00	......
Buildings and land	18	......	78.68
Balance		......	......
Total		$15,000.00	$15,000.00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Treasurer of the South Carolina Experiment Station for the fiscal year ending June 30, 1913; that we have found the same well kept and classified as above; that the balance brought forward from the preceding year was $........ on the Hatch Fund, and $ .... on the Adams Fund; that the receipts for the year from the Treasurer of the United States were $15,000.000 under the Act of Congress of March 2, 1887, and $15,000.00 under the Act of Congress of March 16, 1906; for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving balances of $...... and $.......

And we further certify that the expenditures have been solely for the purpose set forth in the Acts of Congress approved March 2, 1887, and March 16, 1906, and in accordance with the terms of said Acts, respectively.

(Signed) W. W. BRADLEY,
Acting Chairman, Finance Committee, Auditors.

Attest:—
P. H. E. SLOAN,
Custodian.

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION 1912-1913.

(Supplementary Statement)

(This supplementary statement, while not required by law, is desired as an aid in interpreting the account rendered for the United States appropriation. While it will be more useful if made in conformity with the schedule fixed for that appropriation, if this is not practicable, such a summary of receipt and expenditures from the sources indicated below as can be conveniently prepared from the books of the Station may be substituted. Whenever praçticable it should be for the fiscal year ending June 30.)

Debtor

To balance on hand	$2,064.82	
Receipts from other sources than the United States for the year ended	1,681.02	$3,745.84

Credit

By Salaries	$ 742.40
Labor	952.87
Publications	761.14
Postage and stationery............	62.60
Freight and express	157.08

Heat, light, water and power	66.31	
Chemicals and laboratory supplies	......	
Seeds, plants, and sundry supplies	326.37	
Fertilizers	......	
Feeding stuffs	196.00	
Library	47.63	
Tools, machinery, and appliances	52.93	
Furniture and fixtures	29.00	
Scientific apparatus and specimens	....	
Live stock	51.50	
Traveling expenses	76.81	
Contingent expenses	......	
Buildings and land	76.37	
Balance	146.83	
Total		$3,745.84

REPORT OF HORTICULTURIST

Clemson College, S. C., Nov. 15, 1913

Prof. J. N. Harper, Director,
S. C. Experiment Station.

Dear Sir:—

I respectfully submit herewith a report of the Horticultural Division of the South Carolina Experiment Station for the fiscal year ending June 30th, 1913. The work of the Experiment Station has been continued along the same lines as indicated in the annual report of 1912.

Our experiments in breeding okra, asparagus and grapes have been continued. A large number of crosses have been produced in our work with asparagus.

During the past season 450 of our seedling grapes fruited. Only one vine, however, showed special merit. The present indications are that this will be a most valuable variety for the South. A description of this variety will be presented later.

Our breeding work with okra will be continued one year longer. We have now perfected an okra that is exceedingly productive, beginning to set fruit as early as the earliest variety under cultivation and continuing to bear abundantly until killed by frost. The seed from this variety has been distributed throughout the state and to the various experiment stations for testing.

The variety tests of the following vegetables have been continued:—Celery, Irish potatoes, cabbage, onions, sweet potatoes and lettuce. A report of these experiments will be printed at an early date.

The work under project No. 9, of the Adams fund, with Rotundifolia grapes has been continued. A large vine was transferred to the greenhouse during the month of December last and forced to bloom six weeks earlier than the grapes under normal condition. This vine set a large number of fruits which ripened perfectly and produced a normal number of seed, showing conclusively that this vine was not self sterile. This experiment is now being continued on a larger scale and we hope to obtain conclusive results as to the self sterility of a few varieties of this type of grapes in the near future.

Our experiments with the varieties of apples, peaches, plums, Japanese persimmons, pears and grapes have been continued. The Rabun apple fruited again this season and now appears to be one of the most promising seedlings we have yet tested. The quality of this variety is best and it seems well adapted to the more elevated lands in the Piedmont region. This variety has not yet been tested in the central part of this state, but trees have been distributed for this purpose and in the course of a few years we should have valuable data on this and other varieties recently introduced.

Our experiments in growing dasheens furnished by the United States Department of Agriculture last season have been very satisfactory. On May 1st, we planted 1-20 of an acre in rows 3 feet apart and 3 feet apart in the row. They were planted on fertile land that had only been in cultivation three years. The soil was sandy loam with a stiff clay subsoil. The plants grew off rapidly and by mid-summer had attained a height of 3 1-2 feet. Although we had several trying drouths during the summer, the plants continued to grow; they were however, of course checked, to some extent. Had the season been more favorable the yield would have been much greater. Another season we expect to plant dasheens on bottom land and the yield should be much more satisfactory. The yield per acre was 378 bushels. Below is given the number and weight of tubers obtained from one of the best plants in the plot.

One large corm, 6 inches in diameter, weighed 2 1-4 lbs.
Two first sized tubers, 3 1-2 inches in diam. 1 1-2 lbs.
Eight second sized tubers, 2 1-4 in. in diam. 2 1-4 lbs.
Twelve third sized tubers, 1 3-4 in. in diam. 2 lbs.
Fifteen fourth sized tubers, 1 1-2 in. in diam. 1 1-4 lbs.
Total weight for single plant, 9 1-4 lbs.

During the past summer, three of the members of the Horticultural Division spent considerable time in lecturing throughout the State at farmers' institutes.

Yours respectfully,
C. C. NEWMAN,
Horticulturist.

REPORT OF THE BOTANY DIVISION

November 14, 1913.

Prof. J. N. Harper, Director,
S. C. Experiment Station,
Clemson College, S. C.

Dear Sir:

I respectfully submit the following report for the Botany Division of the Experiment Station for the fiscal year ending June 30, 1913.

During the year the lines of investigation previously reported have been continued. In addition to these, several new projects have been taken up. A summary of each phase of the work is given below.

COTTON ANTHRACNOSE

The cotton anthracnose investigation has been continued during the year along the same lines as heretofore and, in addition, several new phases of the life history and habits of the fungus have been studied. The experiments conducted during the year have verified, in a large measure, those conducted in previous years and already reported.

The Kind of Bolls from Which it Seems Safe to Select Seed for Planting.—Two hundred and fifty bolls of cotton were selected from diseased stalks in the field last fall and were examined under the microscope and studied in the laboratory during the winter in the same way as reported for similar bolls in the 1912 report. These seed were planted on land which had never been in cotton and careful tabulations made to show the amount of disease which developed in each case. We found here, as in similar experiments conducted in the past, that it is not safe to select seed for planting from any kind of boll from a stalk which has one or more diseased bolls on it. A number of healthy looking bolls were also selected from diseased stalks and the seed planted on land which had never been in cotton. Half of the seed from each stalk were treated with concentrated sulphuric acid and the other half were not treated. We found about the same amount of anthracnose in the progeny of the treated and untreated seed and anthracnose developed in every case where the seed came from diseased stalks. Seed taken from healthy stalks continued to produce disease free progeny.

Laboratory and Field Tests with Diseased Seed.—Careful centrifuge and germination tests were made of a number of samples of diseased seed and portions of the same samples planted in the field on land which had not been in cotton. We have a history of all these samples and the amount of disease which developed in the fields from which they were taken. We find from these laboratory and field tests that the laboratory test is a safe indication as to the presence of the disease, but so far we have no data which will form a basis for an estimate as to the exact amount of disease that will develop in a field from a given sample of seed.

Seed Treatment.—In our work with different kinds of bolls from diseased stalks, we found many cases where apparently healthy bolls developed on diseased stalks. Microscopic examination showed no fungus on these apparently disease free bolls. It occurred to us that in cases where the disease was scarcely perceptible on the boll, the fungus might not have penetrated the seed coats and some kind of seed treatment might prove effective. We therefore treated the seed from a large number of bolls which came from diseased stalks, but which showed no definite signs of disease either from macroscopic or microscopic examination. We find practically as much disease developing on the treated seed in these cases as on the untreated. The seed were treated with concentrated sulphuric acid long enough to allow the acid to burn off all the lint. This took from three to five minutes. Some of the seed were treated as long as ten minutes without injuring the germination. Where a portion of the general lot of seed taken from a field where there was considerable anthracnose were treated with sulphuric acid and a portion planted untreated, about as much disease developed on the progeny of the treated as on that of the untreated seed.

Virulence of Different Strains of the Anthracnose Fungus, —Glomorella Gossypii—We made inoculations during the summer with five different strains of the fungus, one strain which had been grown in the laboratory during the year, one which was isolated from dead stalks of this year's crop in the field, one which was obtained from a diseased boll collected in the field in the fall of 1912 and kept dry in the laboratory until July, 1913, and two others isolated from diseased bolls in the field during the summer. The strains recently isolated produced an abundance of disease, while the one which had been grown in the laboratory on culture media for a year produced very little infection. The one from the dead stalks produced no infection. These inoculations were made by spraying sterile water containing the spores on to bolls from five to ten days old. With some of the less virulent strains, some inoculations were made by inserting the fungus into punctures made with a sterile needle. The variation in the amount of disease on the same varieties of cotton from year to year indicates that the virulence of the fungus might be an important factor in the amount of damage caused by the disease during a season. We are planning to carry on some work along this line another year.

Survey of Anthracnose in the State This Season.—From what informaton we have been able to gather, the disease seems to be more prevalent in the State this season than ever before. It occurs in every county of the State and reports made by the County Demonstration Agents indicate that it has been very prevalent in all of the counties. The "Half and Half" variety of cotton has been extensively grown again this season in spite of the warning sent out from this office last fall and wherever it is grown, anthracnose is causing very serious loss. A small patch planted in this cotton on the Experiment Station farm with seed sent by the originator himself is even worse diseased than last year. There has been a great demand this year from people who are suffering losses for some one to assist them in selecting disease free seed. We have been unable to do any of this, but have advised the County Demonstration Agents how such selections ought to be made and in many cases they have rendered valuable assistance. We have not been able to make an extensive survey of the amount of disease in the staple cottons this fall, but indications are that there is almost as much disease this year as there was last.

COTTON SHEDDING

The work of cotton shedding has been continued along the same line as last year and, in addition, several new phases of the problem have been studied. Aside from accurate observations and notes made on individual plants during the season in the field, a number of plants have been grown under controlled conditions and data collected as to their requirements, behaviour, etc.

From data obtained in this way, we have been able to determine the amount of water it takes to produce a pound of seed cotton and the amount it takes to produce a pound of dry matter. The amount of water which it takes to produce a pound of seed cotton seems to vary with the fertility of the soil. Where very fertile soil is used or where a large quantity of fertilizer is added, it seems to take only about half as much water to produce a pound of seed cotton as it does where a poor soil without fertilizer is used. The results of this one year's test in this connection indicate that the amount of water taken to produce a pound of seed cotton varies from about eighty to one hundred and twenty-five gallons, depending upon the soil fertility, conditions, etc.

The second year's results with irrigation bear out the first and indicate that where sufficient water is added to the soil during dry, hot spells, cotton shedding can be reduced to the minimum and practically prevented. This indicates that with us soil moisture is the important factor in cotton shedding. A large number of strains of cotton which have shown different percentages of shedding, when grown under practically the same conditions in the field, are being continued with the view of determining whether or not it is practical to breed strains of cotton which would shed less than normal. These results so far are not especially encouraging.

We have also devoted considerable attention to leaf area as correlated with transpiration, shedding, and yield. We have accumulated masses of data along these various lines, but have not yet had time to work them up. It is possible that after we have had a chance to get all of our data tabulated, we might find it advisable to publish what we have as a preliminary report.

COTTON AND COWPEA WILT WORK

This work, which is being carried on in co-operation with the Bureau of Plant Industry of the National Department of Agriculture, has been continued along the same line as heretofore. There was such a great demand for wilt resistant seed during the last winter and spring that it was almost impossible to furnish seed to all who desired them. About one thousand bushels of seed were sold through this office and besides this, quantities were sold by the cooperative breeders themselves. The information at hand indicates that there are about five thousand acres planted this year in seed grown by co-operative breeders. The breeding phase of this work looks especially promising at this time. Many of the progeny rows of last year have shown up remarkably well in increase plots this year and next season we expect to have large fields planted in some of these excellent new strains. This work has only been under way for three seasons and we are just now getting where the results of the breeding work can be seen. That this work is being appreciated is evidenced by the great interest the farmers are taking in it and by the great demand for seed grown by these cooperative breeders. A number of new cooperative breeders have been taken on this year and the work has increased to such an extent that an assistant was needed to help carry on the field end of the work. Mr. J. L. Seal, of this year's class, has rendered efficient service in this connection. Mr. Watson continues to devote a good part of his time to assisting Mr. Gilbert, of the Bureau of Plant Industry, in breeding and hybridization work, looking toward the development of additional strains and varieties of wilt resistant cotton and cowpeas. The larger part of this work is being done at Florence and it is hoped that in the near future some of it can be transferred to the Pee Dee Station there.

PATHOLOGICAL INSPECTION

The end of the first year of the operation of the South Carolina State Crop Pest Commission Act indicates that this Act is going to be of valuable assistance to us in checking the spread of cotton anthracnose. During the past year permits were issued from this office for the sale of twenty thousand bushels of cotton seed for planting purposes. The fact that a number of people have purchased seed during the past season without requiring that they be shipped according to law and have in this way secured badly diseased seed has convinced a great many of the necessity for such a law and there is every indication that in the future, we shall have the hearty cooperation of all the buyers of seed in the enforcement of this law. The transportation companies have expressed themselves as being interested in the enforcement of the law and it is hoped that by the co-operation of all parties concerned, we will be able to prohibit the sale of diseased seed. The other phases of the pathological inspection have been conducted along the same lines as heretofore and have been reported in the annual report of the Pathologist and Entomologist of the State Crop Pest Commission.

PLANT DISEASE SURVEY

The plant disease survey has been conducted along the same lines as heretofore, special attention being given to the prevalence and destructiveness of some of the more common diseases. Several new diseases have also been reported during the year. All of the information gathered along this line is on file in the office of this Division.

Respectfully submitted,
H. W. BARRE,
Botanist and Plant Pathologist.

REPORT OF ENTOMOLOGIST

Clemson College, S. C., Nov. 10, 1913

Prof. J. N. Harper, Director,
S. C. Experiment Station.

Dear Sir:—

I herewith submit my report for the work of the Division of Entomology for the fiscal year ending June 30, 1913.

Adams Fund

There are two projects in progress under this fund, namely, project No. 2, the relation of temperature-moisture to insect activity; and project No. 16, the slender wire-worm of cotton and corn.

The work on temperature-moisture has been progressing under difficulties. The apparatus that has been under construction for over a year for the purpose of obtaining absolute records of both temperature and moisture, is not yet working satisfactorily. It is the writer's belief that after one or two defects have been corrected that it will serve the purpose and therefore it is expected to be in operation about December 1st. Aside from this phase of the work several other phases have been carried on. The question of moisture in relation to hibernation of several species was investigated by means of an accurately standardized balance. A record of daily weights was kept, beginning at a date previous to hibernation and continued through the period of entering hibernation and also through the period of leaving hibernation. The conditions under which different species will hibernate vary greatly. The weight at hibernation was from 28% in the squash bug, Anasa tristis, to 32% in the potato beetle, Leptinotarso decemlineata, lower than constant weight during activity prior to and after hibernation. These insects are very careful in selecting their hibernation quarters and their invariable habit of avoiding places containing a high percentage of moisture leads us to conclude that this reduction in weight is due merely to the elimination of moisture preparatory to hibernation. These same species are less resistant to low temperatures when in a moist environment. No individuals survive the low temperatures of an icebox, 45 to 52 degrees F., when exposed to ice, owing to the saturation of the air. The same phenomena hold true in case of the eggs of Anasa tristis. Eggs kept in a cold water cage at 60 degrees F. hatch a larger percentage of nymphs in a shorter time than the same number of eggs of the same age kept in an incubator at 98 degrees F., there having been no provisions for humidifying the air in the incubator.

Further light was thrown on this question in our work with the little brown click beetle, **Hortistonotus uhleri** in the coast counties. Since the beginning of this investigation, it was known that the larvae are injurious only on barren uplands. It appeared difficult to account for this, owing to the foregone conclusion that humus percentage was the only factor at variance in the soil. Careful records of the past season on the temperature-moisture show that it is not a humus but a moisture factor. The larvae avoid moisture and occur mainly on porous, lean, sandy uplands. They prefer soils that will not saturate at any time. A soil that can be worked immediately after several days of hard rain is a favorable breeding ground for this pest. It is destructive on all soils that have a very porous subsoil. The lowlands, as well as uplands, heavy with humus, contain too high a percentage of soil moisture for this species. The total absence of the factor of parasitism and the almost total absence of predatory enemies makes this species a unique one to work with in connection with this problem.

The habit of this species of going down as deep as thirty inches into the soil during the winter will undoubtedly be explained by the temperature-moisture factor.

Similar work was done with the cotton root louse, Aphis maidiradicis, and its principal attendant ant, Lasius niger americana, but at this writing the records are not sufficiently interpreted to state results. These are being worked up now. The entire subject is complicated and far reaching and it will require years to clear it up.

The report of Mr. H. C. Eagerton, who is in charge of the wire-worm work, is now being prepared for publication as a Station bulletin.

Prof. W. A. Thomas, in charge of the cotton root louse work, is at present preparing his manuscript covering a period of over four years, and this will be submitted as a Station bulletin.

Project No. 16 on the slender wire-worm, has been aggressively prosecuted, Mr. H. C. Eagerton being in charge of the investigation. It appears conclusive that owing to our meager knowledge of this subject, as well as a complete absence of literature on the species in question, that our identification of the species as **Horistonotus curiatus** was premature. This subject has now been disentangled by getting the species located besides accomplishing excellent work on the life history and habits. The species involved in this work are Horistonotus uhleri, Monocrepidius vespertinus and Monocrepidius lividus. The first named is the cause of nearly all the trouble, and the records show it to have an annual life cycle, the adults appearing in June and laying eggs during June, July and August. An important discovery by Mr. Eagerton is the habit of the full grown insects in avoiding packed or undisturbed soil in laying their eggs. For example when the oats is cut and the land is left undisturbed until September 15th a cover crop can be sown and the land may be expected to be free from wire-worm the next spring. If on the other hand this land is plowed up after oats and cowpeas planted on the field, it will become heavily infested with wire-worm. Even a mule walking, during July or August, across a field after the oats has been cut, may have his tracts infested with wire-worm. At present, therefore, our campaign consists of the incorporation of humus on wire-worm infested fields to raise the moisture content of the soil and the manipulation of a three force rotation during July and August. At present it amounts to a total abolition of the use of a cowpea crop following oats.

Co-operative Work with the Bureau of Entomology

The work on the cotton root louse has been continued at the Marion field laboratory with Mr. W. A. Thomas in charge. This work has been in progress for a period of four years. consisting of field and laboratory work. During the year 1911 the aphis was reared during thirty-eight consecutive generations, extending over a period of twelve months, during which period no males appeared. The series was destroyed by the severe freeze in February and the second series was started, which at this writing has reached the fifty-eighth generation, no males having yet appeared. The principal attendant ants are the common corn field ants and several species of minor importance. A long series of repellents was experimented with but none of them have any promise of success. A report of this will be made in a short time in bulletin form.

Co-operative Experimental Work

A series of co-operative fumigation experiments for corn insects in the granary was carried on. Carbon bisulphide was used at the rate varying from seven to ten pounds per hundred bushels. In these experiments much attention was given to crib tightness. This was easily accomplished by means of pasting old wall paper over cracks and the results in general were excellent. A large amount of fumigation with carbon bisulphide was done during the past fall and the results vary directly as the tightness of the crip, percentage of moisture, and the temperature of the atmosphere. The best condition under which to fumigate is to tighten the crib, select a warm day with temperature about 70 degrees, there being some advantage if the day is sultry.

Miscellaneous

The work is in progress on citrus white fly, Aleyrodes citri. This work was organized owing to the attempts to grow the citrus fruits along our coast, and upon the assurance of citizens that is is a very profitable industry. Work is being continued on the gloomy scale of maple.

—Thanking you for your co-operation, I am

Very truly yours,
A. F. CONRADI,
Entomologist.

REPORT OF CHEMIST

Clemson College, S. C., Nov. 14, 1913.

Prof. J. N. Harper, Director,
S. C. Experiment Station.

Dear Sir:—

I respectfully submit the following report for the fiscal year ending June 30th, 1913.

Work Under the Adams Act

Project 4.—To determine if the feeding of large amounts of cotton seed meal to cows produces any physiological or pathological effects that would cause abortion (in co-operation with Division of Animal Husbandry).

Three pens of two cows each have been in this experiment since June and it is planned to continue this work through one or more periods of gestation. Different rations are fed to each pen. A chemical analysis is made of a sample of urine from each cow once every two weeks.

Project No. 5.—An experiment to determine the cause of cotton seed meal poisoning in hogs (in co-operation with the Division of Animal Husbandry).

Our work on this problem shows that there is a great difference in the toxicity of different meals. At present we are seeking a highly toxic meal to check some of our past results.

Project 12.—Some factors affecting the composition of cotton seed with special reference to the content, location in the seed, and form, of the phosphorus in the upland varieties of cotton. A study of methods of analysis was necessary before this work could be advantageously prosecuted.

Project 17.—A study of the cause of the partial insolubility in water of potash salts when mixed with Thomas phosphate or basic slag. This work has been completed and presented for publication in bulletin form. The following is a synopsis of the results obtained:

1.—When either muriate of potash or kainit is mixed with basic slag, a part of the potash soluble in water before mixing is rendered insoluble.

2.—This insolubility is due to the formation of a compound insoluble in water, but almost entirely soluble in hydrochloric acid of a Sp. Gr. of 1.115.

3.—Some of this potash, as well as some other elements in the mixtures, is partially soluble in both citric acid and in ammonium citrate of Sp. Gr. of 1.09.

4.—The other elements determined:silica, "ammonia precipitate," and lime were more soluble in citric acid than in ammonium citrate of Sp. Gr. 1.09; while, on the other hand, potash was more soluble in ammonium citrate solution.

This is accounted for by a probable substitution of the ammonium radicle (NH_4) for potassium in the compound.

5.—It is shown that there is no definite relation between any one of the elements soluble in citric acid or in ammonium citrate and the potash soluble in the same solvent.

6.—It is a very tedious operation to separate the potash soluble in hydrochloric acid of 1.115 Sp. Gr. from the other materials made soluble by the same solvent and precipitated by means of ammonia. This can be accomplished only by using large dilutions and many precipitations.

7.—Basing our work on the difficulty of separating the potash present from the "ammonia precipitate," a study was made of the influence of the large "ammonia precipitate" always present in the determination of potash in mixed fertilizers by our Official Method for solution.

8.—The results of this investigation show that there are two partially compensating sources of error in our Official Methods of solution:—

(a) The volume is decreased by the bulk of the precipitate in the flask, which would tend to increase the percentage of potash present.

(b) The potash is decreased by occlusion of potash by the heavy precipitate formed on addition of ammonia and ammonium oxalate. These two sources of error tend to balance to some extent.

9.—It is impossible to wash out the potash occluded within the precipitate with hot water.

10.—The occluded potash can be separated to a certain extent by repeatedly dissolving the precipitate in hydrochloric acid, diluting to a volume of about 400 cc., precipitating with ammonia and ammonium oxalate, and filtering to determine potash in the filtrates.

11.—The use of pure salts in making the solutions shows that both iron and calcium phosphate, when precipitated with ammonia, occlude potash, and that a combination of the two is even more effective to produce occlusion.

Fertilizer Tests

The fertilizer field tests are being continued along the lines indicated in our last report. This work has been materially strengthened by the addition of 168 one-tenth acre plots at the Pee Dee Station. Some very interesting results have been obtained at Summerville and at Clemson which will be presented in bulletin form at an early date.

General Laboratory Work

We have studied the lime content of Thomas phosphate and find that the lime is slightly soluble in water but that the material continues to give up a small amount of lime each time that the washings are repeated. These washings have been made at intervals during a period of about one year.

A considerable number of soil analyses have been made during the past year. In addition to the above work a considerable number of miscellaneous analyses have been made.

Publications

Bulletin No. 173, "Potash in Mixed Fertilizers."
Circular No. 9, "Lime for South Carolina Soils."

Farmers' Institutes

About two weeks of the past year was devoted to institute work in the eastern section of the state.

Very truly yours,
T. E. KEITT,
Chemist.

Clemson College, S. C.,
November 17, 1913.

Director J. N. Harper,
Clemson College, S. C.

Dear Sir:

I beg to submit the following relative to experimental work being done by the Division of Animal Husbandry and Dairying. Projects 4 and 5 are in co-operation with the Division of Chemistry of the Agricultural Experiment Station:

Project No. 4: **Physiological and Pathological effect of Feeding large Amounts of Cotton Seed Meal to Cows:**

This project was started prior to my taking charge of the work of this Division. Until the first day of May last, the plan of this experiment was continued as last year, eight cows being used in the experiment, four of which were fed cotton seed meal as a sole concentrate. We deemed it advisable to change the plan of procedure somewhat, and at the same time already indicated we selected six Jerseys for continuing the experiment. Three of the aged cows that were included in the test prior to May first, were selected and in addition we selected three heifers. Wide, narrow and medium rations are being used with these animals,—cotton seed meal constituting the narrow and heavy ration, while a balanced ration is used as a check.

Project No. 5: **An Experiment to Determine the Cause of Cotton Seed Meal Poisoning in Hogs:**

This project is also being considered. Naturally, the first problem involved is to test the toxicity of the cotton seed meal. On December 14, we selected four Tamworth pigs of the same litter for this test,—feeding three on cotton seed meal and middlings, while the fourth was fed middlings alone, as a check. The cotton seed meal fed constitutes upland meal in one case, lowland meal with a second, and Sea Island meal with a third, thus testing not only the toxicity of the meal, but the comparative degrees of toxicity, as well. On June 15, after a six months' trial with Tamworth hogs, we started a duplicate test with four Berkshire X Essex pigs.

For several seasons this Division has been feeding the

Mess Hall slops to pigs. This fact has suggested the importance of ascertaining as near as possible the value of slops, as compared with corn and other hog feeds. On April 12, we selected nine Berkshire X Tamworth pigs of uniform size for slop feeding. These were divided into lots of three each and fed under specific conditions. This experiment lasted until the College closed down, at which time no slops were longer available. This experiment will be taken up again during this session. In conducting this experiment, we realize, of course, that slops are more or less variable in composition. However, we feel that we should be able to get sufficient data on the subject to give us at least a reasonable idea of the value of slops in pig feeding. This is a matter that should interest a large number of families over the State, whether they live on the farm or in the small towns, as many of them desire to raise at least a few hogs for home consumption. It seems evident that much economy is involved in this method of making use of the kitchen slops, etc.

These experiments are now well under way, but not completed and of course no results can be reported at this writing.

Experiments are also being made with hog pastures. Comparisons are being made of the different suitable forage crops for this purpose. The grazing period, as well as the comparative value of these forages in pork production are being considered.

This Division has arranged to co-operate with the United States Department of Agriculture in live stock Demonstration work, and it is my desire and intention to inaugurate practical experiments in beef cattle production, as well as with other lines of live stock. I feel that this station should provide, as soon as possible, for experiments with beef cattle feeding, and parallel this work with the experimental breeding already provided for, and to be taken up as soon as funds are available.

Very sincerely,
R. L. SHIELDS,
Chief of Division of Animal
Husbandry and Dairying.

Clemson College, S. C.,
November 21, 1913.

Prof. J. N. Harper, Director,
South Carolina Experiment Station,
Clemson College, S. C.

Dear Sir:—

I have the honor to submit the Annual Report of the Division of Agronomy of the South Carolina Experiment Station for the fiscal year ending June 30, 1913.

I began work for the College in August 1912 and since that time I have aided the Director with the agronomy work of the Station. Mr. F. G. Tarbox, Mr. Frank T. Wilson, and Mr. Burns Gillison have also aided with the work. Mr. Frank T. Wilson began work for the College in September 1912 and resigned in June 1913. He rendered assistance in testing varieties of corn and also ear to row test with corn in 1913.

No new lines of work were undertaken during the period covered by this report, but an earnest effort was made to have the work in progress go forward successfully.

Work With Soils.—Good land is an important factor in profitable agriculture and it is also desirable to have cultivated land show a tendency to retain permanently a high productive power. Hence the importance of soil studies that have to do with its productive characters. No sort of soil management can keep soils productive if they be allowed to wash or erode very much and to prevent any serious erosion is of fundamental importance. The soils being used by this Division are, as a rule, hilly and prone to serious erosion. The system of terracing and tillage in use prevents erosion to an unexpected degree, but if the run-off water was conducted into tiles at suitable intervals instead of permitting it to run over the surface from the top to the bottom of the slope, there would be appreciably less erosion and it doubtless would be made so efficient as to satisfy the demands for a permanent agriculture. Besides preventing erosion, these tile drains could be made to prevent the injury to crops on certain parts of the area where water sometimes remains too long for best results.

In plowing each area between two terrace embankments, each furrow slice is turned down hill and this, together with an appreciable movement of soil to the lower side of the area by the run-off water, results in bringing each area to a level or gentle slope and makes a deeper or more productive soil on the lower half, giving something of a stairstep effect to the surface.

In growing crops on these lands much dependence is put on the kind and amount of fertilizer used so that the word "fertility," when used in connection with these soils, must refer mainly to the amount of organic matter present, the mechanical condition,, and the consequent water supply. The power of these soils to produce crops is very variable even when the same kinds and amounts of fertilizers are used. Besides the differences indicated above, each terrace area may contain both gray and red types of soil. All this variation makes accurate tests along certain lines exceedingly difficult, but does not interfere with the improvement of any of these areas. The improvement may vary in degree, and while the exact degree of improvement may not be easy to manage, its general character is usually apparent.

Some organic matter is plowed into the soils being used each year--more on some areas than others. Where the most organic matter is added, there the best crops grow. We might try and add some matter on some areas somewhat faster than has been the case. At least we may do so wherever it is feasible. As a rule there is not that vigorous growth of leguminous crops, when they occupy the land, that I like to see and that always indicates satisfactory conditions for other crops such as corn, cotton, wheat, etc. The legumes do not grow big enough. I hope we may find an easy and economical way to make cowpeas grow so as to have large, vigorous plants. Burr clover makes a vigorous growth.

Fertilizers.—The Agronomy Division does not conduct the main fertilizer studies. It is in the habit of using a complete fertilizer, in fairly large quantity, under all crops with a top dressing of nitrate of soda when the crop has reached a certain stage, usually a few weeks before the fruiting stage, but, in case of cotton, when about half the fruit has been set.

The Division, however, has made a number of tests with lime and on one plat finely ground raw rock phosphate is used as the only source of phosphorus. Apparently the lime does not show any beneficial effects save with leguminous crops. Certainly the good effects of lime are not so great, nor so sure, nor so general as are those of phosphates and nitrates.

The plat on which raw phosphate is used has not reached a point yet where the results may be regarded as good. It still lacks something. Cowpeas occupied this land this season and at no time did they have a vigorous appearance and when mature the growth was too small to be regarded as satisfactory. We may have to put a light dressing of manure on this plat to give the legumes a proper start.

Crop Studies.—Each year the Station has growing on its plats quite a number of crops, but only a few that have superior merit stand any chance of being extensively grown in the State. Cotton, tobacco, corn, and cowpeas are summer crops with very great outstanding merit. Oats and wheat occupy a similar position as winter season crops. For pasture purposes, Bermuda and Lespedeza take front rank and for hays, cowpeas and sorghum. These crops seem to be in a class by themselves. Vetch, burr clover, crimson clover, rye, barley, peanuts, soy beans, and alfalfa, all are crops with good qualities, but apparently they cannot compete with the other crops mentioned.

Perhaps the function of rye, burr clover, and crimson clover is to serve as winter cover crops.

A small plat of timothy and red clover has given such good results for hay as to deserve a trial, by the Station, on a much larger scale. The area was planted in 1910 and has given a good yield of hay for three years. The yield is at the rate of two to three tons per acre. Apparently timothy and red clover would make a good hay proposition in the Piedmont section.

A variety of awnless barley has been grown on a small scale for two or three years. It has outstanding merit as an early hay crop. We should grow this on a scale large enough to see what its relative value is as a forage crop.

Where existing conditions make its growth sure and easy, alfalfa is the best of hay crops. The Station has grown alfalfa for three or four years on quite small areas. It takes a good deal of fixing to make these soils grow it. We should endeavor to find its true place in the cropping systems of this State.

Sudan grass, grown this year, is a hay plant with many good qualities. We should determine if it be better than any of the hay plants now generally grown.

A large percent. of the many varieties of cotton has been grown on the Station grounds. Of the short staple kinds, Cook's Improved Big Boll will make as much money as any, though the fibre is not of the best quality. By selection, the fibre could be improved and the bolls made to average somewhat larger.

None of our varieties give a uniform progeny. As cotton does not cross so very much, it may be that much greater uniformity in varieties can be secured.

The soils of this Division are not very good corn lands, though very fair yields may be had by the liberal use of fertilizers, especially nitrates. To accurately determine the relative merits of varieties as to yield, is not easy on soils that vary far more than the varieties. The Station has grown many varieties of corn and the tests indicate some varieties to be better than others although variety differences in yields are small as a rule when compared with differences in yields due to soils. Mosby, perhaps, has as good yielding power as any other variety. Each variety consists of many types and certainly it is desirable to separate these in order to have more uniformity in the corn grown. Many of our best yielding varieties are veritable mixtures.

The project to determine the varieties best suited to the different soil types of the State has been entirely in the hands of Mr. Tarbox. To determine this, he sent seeds of different varieties to farmers in different parts of the State who agreed to plant them and send samples of the cotton grown and report yields obtained. The character and quality of the fibres in the samples received were determined.

The Director has had charge of the work in cotton breeding in so far as it relates to type and yield. Selections and stalk to row tests have been made. Blue Ribbon, a hybrid cotton, was used for the selections. Improvement may be noted in the size of the bolls, the characters of the fibres, and the manner of fruiting. Two or three acres of this cotton have been grown this year.

For five years pollen from barren stalks of corn has been used to fertilize the pistils of fruitful stalks and the corn thus grown planted the following year to determine the influence of such breeding on the tendency of the progeny to be barren. In comparison with this, other corn has been planted where both parents were both fruitful and prolific.

The absence of any marked increase of barren stalks in the progeny where one parent was clearly inherently barren continues.

Farm Management.—At the Agronomy Barns are ten head of mares and colts, all descended from a German Coach mare named Pat. The mares help with the farm work and doubtless do enough to pay for their keep, but they are handled carefully and the work they do seems rather to be helpful in regularly raising healthy, well-formed colts than otherwise. It is a good demonstration and shows that proper work, with good attention, may even be rather beneficial to brood mares than hurtful.

Progress 1913.—The present calendar appears to have been generally favorable to such crops as have been grown. The farm manager, Mr. Burns Gillison, thinks that the crops as a rule are unusually good, and, perhaps in some cases at least, setting a precedent for good average yield. The cotton is good, but too late. More stress should be laid on having the cotton earlier More early plowing and less late spring plowing might be all that was necessary to secure an earlier maturity.

Respectfully,
W. L. HUTCHINSON,
Associate Agronomist.

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